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06EC73

Seventh Semester B.E. Degree Examination, May/June 2010
Power Electronics

Time: 3 hrs. Max. Marks:100

Note: ***Answer any FIVE full questions, selecting at least TWO questions from each part.***

PART – A

1 a. List out some applications of power controller. **(06 Marks)**

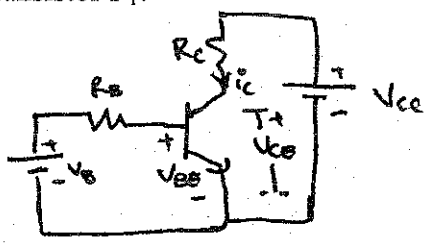
b. Write the characteristic features of following power devices.
i) SCR ; ii) TRIAC ; iii) LASCR ; iv) MCT ; v) SITH. **(10 Marks)**

c. Compare the characteristic of power MOSFET and 1GBT. **(04 Marks)**

2 a. Discuss the steady state characteristics power MOSFETS compare this with characteristics of power BJT. **(10 Marks)**

b. The beta (β) bipolar transistor shown in Fig.2(b) below varies from 12 to 75. The load resistance $R_C = 1.5\ \Omega$. The dc supply voltage is $V_{CC} = 40$ V and input voltage to the base circuit $V_B = 6$V, if $V_{CE(sat)} = 1.2$ V, $V_{BE(sat)} = 1.6$ V, $R_B = 0.7\ \Omega$. Determine :
i) Overdrive factor (ODF)
ii) The forced β and
iii) The power loss in the transistor P_T. **(10 Marks)**

Fig.2(b)



3 a. Define the following term with respect to SCR :
i) Latching current ; ii) Holding current
iii) Turn-on time ; iv)Turn off time. **(08 Marks)**

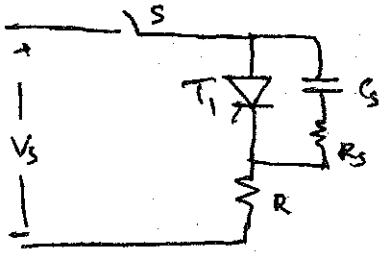
b. The latching current for SCR inserted in between a dc voltage source of 200 V and load is 100 mA. Calculate the minimum width gate pulse current required to turn-on this SCR in case the load consist of i) L = 0.2 H ; ii) R = 20 Ω in series with L = 0.2 H. **(06 Marks)**

c. With help of neat circuit diagram and waveforms, explain RC firing circuit used with half controlled rectifier. **(06 Marks)**

4 a. What is the need of di/dt protection and dv/dt protection? Explain how protection is provided. **(04 Marks)**

b. The input voltage of Fig.4(b), $V_s = 200$ V with load resistance R = 5 Ω and the load and stray inductance are negligible and thyristor is operated at $f_s = 2$ kHz. If the required dv/dt is 100 V/μs. The discharge current is limited to 100 A. Determine :
i) The values R_s and C_s ; ii) The snubber loss. **(08 Marks)**

Fig.4(b)



c. Explain the operation of single phase semi-converter with highly inductive load. Derive the expression for V_{dc} and V_{rms}. **(08 Marks)**

PART – B

5 a. What is forced commutation? With help of neat diagram and relevant equations, explain the operations of self commutation circuit. **(10 Marks)**

b. Derive the equation for turn-off time of SCR in impulse commutated circuit for the following circuit. For the impulse commutated thyristor circuit shown in Fig.5(b). Determine turn-off time of the circuit for R = 10 Ω and C = 20 μF and supply voltage V_s = 220 V. **(10 Marks)**

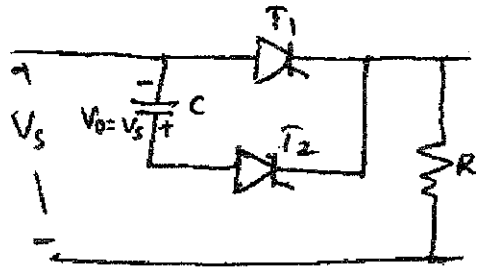


Fig.5(b)

6 a. What are advantages and disadvantages ON-OFF control and phase control of ac voltage controller? **(08 Marks)**

b. For the AC voltage controller shown in the following fig.6(b), the delay angles of thyristors are equal and $\alpha_1 = \alpha_2 = \frac{2\pi}{3}$. Determine the :

i) RMS O/P voltage
ii) Input power factor
iii) Average and Rms current of the thyristors.

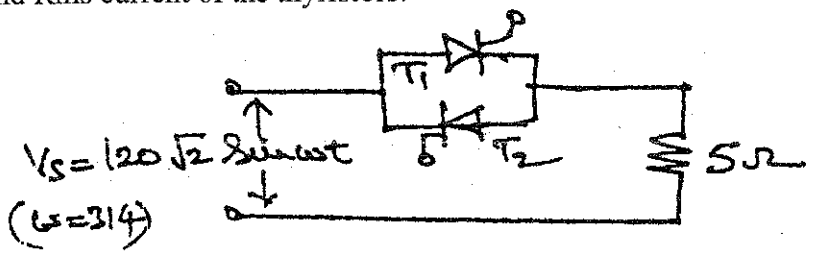


Fig.6(b)

(12 Marks)

7 a. What is chopper? Explain principle of step up chopper with relevant equations. **(10 Marks)**

b. Give the classification of chopper. Explain briefly each one of them. **(10 Marks)**

8 a. Write the principle of operation of 1 - ϕ inverter with relevant diagram and waveform. Also discuss the performance parameter. **(10 Marks)**

b. The 1 - ϕ full bridge inverter has resistive load R = 2.4 Ω the dc input voltage V_s = 48 V. Determine :

i) RMS output voltage at fundamental frequency
ii) The output power
iii) The average and peak current of each transistor. **(10 Marks)**

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